Vol. 15, No. 3 PSYCHOLOGICAL REVIEW PUBLICATIONS March, 1918

Psychological Bulletin

CONTENTS

PUBLISHED MONTHLY BY THE

PSYCHOLOGICAL REVIEW COMPANY

NORTH QUEEN ST., LANCASTER, PA.,

AND PRINCETON, N. J.

Agents: G. E. STECHERT & CO., London (2 Star Yard, Carey St., W. C.); Leipzig (Koenigstr., 37); Paris (16, rue de Condé)

Entered as second-class matter January 21, 1904, at the post-office at Lancaster, Pa., under Act of Congress of March 3, 1879

Psychological Review Publications

EDITED BY

HOWARD C. WARREN, PRINCETON UNIVERSITY (*Review*)
JOHN B. WATSON, JOHNS HOPKINS UNIVERSITY (*J. of Exp. Psych.*)
JAMES R. ANGELL, UNIVERSITY OF CHICAGO (*Monographs*)
SHEPHERD I. FRANZ, GOVT. HOSP. FOR INSANE (*Bulletin*)
MADISON BENTLEY, UNIVERSITY OF ILLINOIS (*Index*)

WITH THE CO-OPERATION OF
MANY DISTINGUISHED PSYCHOLOGISTS

PSYCHOLOGICAL REVIEW

containing original contributions only, appears bimonthly, January, March, May, July, September, and November, the six numbers comprising a volume of about 480 pages.

PSYCHOLOGICAL BULLETIN

containing critical reviews, notices of books and articles, psychological news and notes, university notices, and announcements, appears monthly, the annual volume comprising about 480 pages. Special issues of the BULLETIN consist of general reviews of recent work in some department of psychology.

JOURNAL OF EXPERIMENTAL PSYCHOLOGY

containing original contributions of an experimental character, appears bimonthly, February, April, June, August, October, and December, the six numbers comprising a volume of about 480 pages.

PSYCHOLOGICAL INDEX

is a compendious bibliography of books, monographs, and articles upon psychological and cognate topics that have appeared during the year. The INDEX is issued annually in May, and may be subscribed for in connection with the periodicals above, or purchased separately.

ANNUAL SUBSCRIPTION RATES

Review and Bulletin: $6 (Foreign, $6.50). **Journal:** $3.25 (Foreign, $3.50).
Review and Journal: $6 (Foreign, $6.50). **Bulletin:** $3.25 (Foreign, $3.50).
Journal and Bulletin: $6 (Foreign, $6.50).
Review, Bulletin and Journal: $9 (Foreign, $9.75).
Index with any other two: $7 (Foreign, $7.50).
Review, Bulletin, Journal and Index: $10 (Foreign, $10.75).
Current Numbers: Review, 65c; **Bulletin,** 35c; **Journal,** 65c; **Index,** $1.25.

PSYCHOLOGICAL MONOGRAPHS

consist of longer researches or treatises or collections of laboratory studies which it is important to publish promptly and as units. The price of single numbers varies according to their size. The MONOGRAPHS appear at irregular intervals and are gathered into volumes of about 500 pages with a uniform subscription price of $4.. (Postal Union $4.30.)

Philosophical Monographs: a series of treatises more philosophical in character.

Library of Genetic Science and Philosophy: a series of bound volumes.

Subscriptions, orders, and business communications may be sent direct to the

PSYCHOLOGICAL REVIEW COMPANY
Princeton, New Jersey

FOREIGN AGENTS: G. E. STECHERT & CO., London (2 Star Yard, Cary St., W. C.); LEIPZIG (Koenigstr., 37); PARIS (16, rue de Condé)

Vol. 15, No. 3. March, 1918

THE

PSYCHOLOGICAL BULLETIN

A NOTE ON MEASUREMENT BY RELATIVE POSITION

BY S. C. KOHS

Buckel Foundation, Stanford University

A few difficulties are generally encountered in the use of Thorndike's method of measurement by relative position.[1] The more important ones are:

(*a*) Total agreement between judges is given a value of ∞.

(*b*) One is advised to interpret the value of ∞ as 2 P.E., later on.

(*c*) The Δ table is given for divisions of opinions between two to fourteen judges. A table giving P.E. differences up to twenty judges would be a considerable aid.

(*d*) Inspectional arrangement of judgments may yield an unreliable lineation of the subjects judged.

The following suggestions may assist the elimination of these difficulties:

(*a*) "Total Agreement" for judges *under* 100 may be considered equal to 4.6 P.E. And "Total Agreement" for judges *over* 100 may be taken equal to 6 P.E.

(*b*) In the table which is herewith presented "Total Agreement" is given a value of 4.6 P.E., a figure more in harmony than 2 P.E. with the progress of the judgment-differences.

(*c*) This table also extends Thorndike's original list to include judgments of from fifteen to twenty judges.

(*d*) It is advised that instead of arranging a series of judgments by inspection, the arithmetic mean be utilized for this purpose.

Reasons for the Changes.—(*a*) and (*b*) Theoretically, if the total

[1] E. L. THORNDIKE, "Technique of Combining Incomplete Judgments of the Relative Positions of *N* Facts, Made by *N* Judges." *J. of Philos., Psychol. & Sci. Meth.*, 1916, 13; 197–204.

number of judges agree, placing one fact measured above another, that particular fact is at an *infinite* distance above the other. For practical purposes this limit is given an arbitrary numerical value, which can be made reasonable even though arbitrary. Thorndike originally assigned to ∞ the value 2 P.E. Reference to the original Δ Table will make the incongruity of this value evident. Thus in the case of 14 judges a division of 12 to 2 equals 1.58 P.E.; 13 to 1, 2.17 P.E.; and 14 to 0, ∞ or 2 P.E.! If anything, it should be more than 2.17 P.E. This point is still more striking when dealing with 20 judges. A division of 18 to 2 equals 1.90 P.E.; 19 to 1, 2.44 P.E.; and 20 to 0, 2 P.E.!

Now to reply to the possible query, why 4.6 P.E. has been chosen as the more reasonable value to substitute for ∞. If we had 100 judges, a division of opinion 100 to 0 equals a difference between adjacent facts or items equal to $\frac{50}{100}$ or 0.500, which equals ∞. (See P.E. Table.) A division of 99 to 1 equals a difference between facts of $\frac{49}{100}$ or 0.4900, which equals 3.45 P.E. Evidently the 100 to 0 division should be greater than 3.45 P.E. How much greater can be determined empirically by plotting the P.E. values for each division of opinion from 50–50 to 99–1, and continuing the curve onward to 100–0.

Again, if we had 1,000 judges, a division of 999 to 1 equals a difference between facts of $\frac{499}{1000}$ or 0.499 which equals 4.62 P.E. Consequently a division of opinion of 1,000 to 0 should be greater than 4.62 P.E.

Since 100–0 should be greater than 3.45 P.E., and since 1,000–0 should be greater than 4.62 P.E., it seems reasonable to place the 100–0 division of opinion equal to 4.6 P.E. It is deemed advisable not to change, as yet, the value of ∞ from 4.6 P.E. for any number of judges below 100. In fact it is highly probable that most of the studies which will utilize this method will not exceed judgment of over 100 judges. Should tables be devised for judges above 100 it would seem more logical to interpret ∞ equal to 6 P.E.,[2] which, for practical purposes, is understood to include half the range of a normal probability surface, with the median as the dividing line.

[2] Further mathematical study is necessary to determine whether the P.E. values for "Total Agreement" should increase as the number of judges increases. There are as many off-hand reasons for arguing progression as for non-progression. More careful analysis of this matter is necessary.

It is an open question whether in educational or psychological data ∞ should ever be interpreted greater than 6 P.E.

(*d*) Since the final assignment of P.E. values to the various items or individuals judged is dependent upon how accurately the preliminary seriation of the items or the individuals is made, it is essential that this preliminary arrangement of judgments be made as accurately as possible. It is evident that arrangement by inspection is too largely affected by accidental factors and individual idiosyncrasies. This variation in initial arrangement might, with exactly the same raw data, yield different final results in the case of two random inspectors. But this factor of variation in arrangement can be eliminated if the arithmetic mean of the judgments for each fact or individual is found, and the preliminary seriation made dependent on these mathematical results. The arithmetic mean is selected in preference to any other average for the reason that equal weight is given to the opinion of each expert or judge. To the problems which this method has found application here, this procedure of determining the original lineation of items, followed logically our preliminary modification of the Thorndike procedure by directing the judges to assign to the items judged, values between 1 per cent. to 100 per cent. according to the position of a given item in a group with reference to *all* the others in this group.

Applications of the Method.—Mr. F. E. Barr and Mr. E. J. Buckles have been kind enough to permit me to utilize here a portion of their final data in their application of this method to the devising of an occupational scale which they promise for early publication.

Hobo	0 P.E.
Track Layer	4 P.E.
Metal Finisher	8 P.E.
Librarian	12 P.E.
Artist	16 P.E.
Inventive Genius	20 P.E.

It does not require a great deal of psychological or statistical insight to appreciate the general value of such a scale to that suggested by Taussig or Saffiotti.

The writer is indebted to Mr. J. F. Abel and Mr. K. M. Cowdery, graduate students in advanced educational statistics, whose wrestling with the problem has led him to this refinement in technique.

Δ Table

THE DIFFERENCES IN TERMS OF P.E. CORRESPONDING TO ANY DIVISION OF OPINIONS AMONG 2, 3, 4, 5, . . . 20 JUDGES

N	*D*	Δ	*N*	*D*	Δ	*N*	*D*	Δ	*N*	*D*	Δ
2	1–1	0.00	10	5–5	0.00	14	7–7	0.00	18	9–9	0.00
2	2–0	4.60	10	6–4	0.38	14	8–6	0.27	18	10–8	0.21
			10	7–3	0.78	14	9–5	0.54	18	11–7	0.42
3	2–1	0.64	10	8–2	1.25	14	10–4	0.84	18	12–6	0.64
3	3–0	4.60	10	9–1	1.90	14	11–3	1.17	18	13–5	0.87
			10	10–0	4.60	14	12–2	1.58	18	14–4	1.13
4	2–2	0.00				14	13–1	2.17	18	15–3	1.43
4	3–1	1.00	11	6–5	0.17	14	14–0	4.60	18	16–2	1.81
4	4–0	4.60	11	7–4	0.52				18	17–1	2.36
			11	8–3	0.90	15	8–7	0.12	18	18–0	4.60
5	3–2	0.38	11	9–2	1.35	15	9–6	0.38			
5	4–1	1.25	11	10–1	1.98	15	10–5	0.64	19	10–9	0.10
5	5–0	4.60	11	11–0	4.60	15	11–4	0.92	19	11–8	0.30
						15	12–3	1.25	19	12–7	0.50
6	3–3	0.00	12	6–6	0.00	15	13–2	1.65	19	13–6	0.71
6	4–2	0.64	12	7–5	0.31	15	14–1	2.23	19	14–5	0.94
6	5–1	1.43	12	8–4	0.64	15	15–0	4.60	19	15–4	1.19
6	6–0	4.60	12	9–3	1.00				19	16–3	1.49
			12	10–2	1.43	16	8–8	0.00	19	17–2	1.86
7	4–3	0.27	12	11–1	2.05	16	9–7	0.23	19	18–1	2.40
7	5–2	0.84	12	12–0	4.60	16	10–6	0.47	19	19–0	4.60
7	6–1	1.58				16	11–5	0.72			
7	7–0	4.60	13	7–6	0.14	16	12–4	1.00	20	10–10	0.00
			13	8–5	0.44	16	13–3	1.32	20	11–9	0.19
8	4–4	0.00	13	9–4	0.74	16	14–2	1.71	20	12–8	0.38
8	5–3	0.47	13	10–3	1.09	16	15–1	2.27	20	13–7	0.57
8	6–2	1.00	13	11–2	1.51	16	16–0	4.60	20	14–6	0.78
8	7–1	1.71	13	12–1	2.11				20	15–5	1.00
8	8–0	4.60	13	13–0	4.60	17	9–8	0.11	20	16–4	1.25
						17	10–7	0.33	20	17–3	1.54
9	5–4	0.21				17	11–6	0.56	20	18–2	1.90
9	6–3	0.64				17	12–5	0.80	20	19–1	2.44
9	7–2	1.13				17	13–4	1.07	20	20–0	4.60
9	8–1	1.81				17	14–3	1.38			
9	9–0	4.60				17	15–2	1.76			
						17	16–1	2.32			
						17	17–0	4.60			

N = No. of judges. *D* = Nature of division among the judges. Δ = Corresponding differences in terms of P.E.

SPEED OF PRESENTATION AND EASE OF RECALL IN THE KNOX CUBE TEST

BY L. M. RACHOFSKY

Carnegie Institute of Technology

While giving the Knox Cube Test in the individual examinations of Carnegie Institute of Technology freshmen we noticed that the scores of the subjects were markedly affected by variations of the speed with which the examiners presented the test. This suggested promising material for a study of the relation between speed of presentation and ease of recall, a phase of the speed and accuracy problem. Accordingly we undertook the present investigation.

High-school students were selected to serve as subjects. We had found by a few preliminary trials that it would be impossible to use only a few subjects who would repeat the test again and again at different speeds; for they would learn the test so well after a few sittings that practically no variation in the number of errors would occur, no matter at what speed the test were given. Since for the purpose of our experiment a subject could be given the test only once, it was necessary to secure a large homogeneous group, and high-school students most closely fulfilled these requirements. In order to eliminate as many variables and make the group as homogeneous as possible only senior and junior boys were selected.

The apparatus consisted only of the Knox Cube Board, a strip of board twenty by two inches upon which are fixed four colored cubes at intervals of five inches, and a silent pendulum. The subject is seated at a table opposite the examiner with the test board placed between them. The examiner taps the blocks in a certain order, maintaining a constant speed of tapping by means of the silent pendulum. The subject is then instructed to tap the blocks in the identical order. The examination consists of ten such problems, each problem being repeated once before proceeding to the next. One error only is allowed for each problem; thus it is theoretically possible to make twenty errors. A perfect score is extremely rare, so there is opportunity for a good distribution.[1]

[1] Pintner, R., "The Standardization of the Knox Cube Test," *Psychol. Rev.*, 1915, 22.

Since the object of the experiment was to discover the relation between the speed of tapping by the examiner and the accuracy of the subjects' recall, the students were divided into several groups of equal size so that each group might be given the test at a different speed. The following speeds were selected: one tap per half second, one tap per three fourths second, one tap per one second, one tap per one and one fourth seconds, one tap per one and one half seconds, one tap per one and three fourths seconds, one tap per two seconds. It would have been desirable to have gone beyond the half second speed, but it was found physically impossible to tap so fast at a constant rate. Neither the time nor the subjects were available to go beyond two seconds. In all cases the subjects were allowed to respond at whatever speed they desired, regardless of the speed at which the examiner tapped.

The results when plotted appear as in the accompanying graph. The abscissæ represent the time per tap in seconds, and the ordinates represent the average number of errors. From this curve it appears

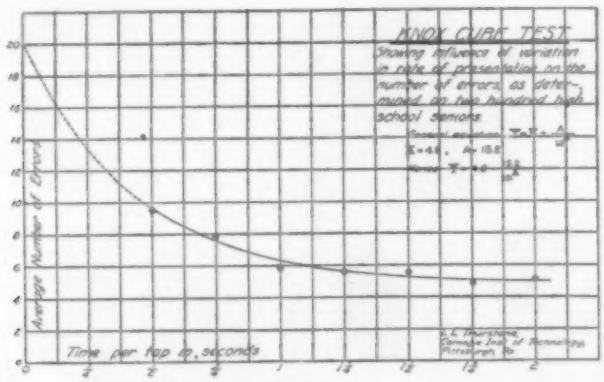

Fig. 1.

that accuracy of recall increases inversely to the rate of presentation; or the slower the examiner presents the test the fewer the number of errors the subject makes. Mr. L. L. Thurstone has stated this relation analytically by the empirical equation,

$$Y = K + \frac{A}{10^{x}},$$

in which Y represents the average number of errors for about twenty-five subjects, X represents the examiner's speed of tapping

in taps per second, and K is a constant. The dotted part of the curve is an extension of the equation beyond the empirical data. We know that if the test were given at an infinite speed the subject would miss all the problems and the curve would then intersect the Y axis at 20. The significant feature of this curve is that the ease of recall seems to be a continuous function of the speed of presentation in the Knox Cube Test.

It would have been interesting to have continued the experiment beyond the speed of two seconds; for eventually the factor of forgetting would have set in and the number of errors would increase as the speed of presentation decreased. This would finally have resulted in a U-shaped curve.

These results may be of some value in the mental test field, where the Knox Cube Test is extensively employed, notably in the Army tests. The speed ordinarily prescribed for giving the test is one tap per second. Since there is a tendency on the part of examiners to go too fast, and since the curve begins to rise rapidly at one second, a pronounced increase in the number of subjects' errors will result; and the comparability of individual records will be seriously impaired. On the other hand, a mistake in giving the test too slow, while still noticeably affecting the score, would not be so serious as going too fast, inasmuch as the curve begins to drop much less rapidly to the right of one second. The ideal speed would seem to be at about one and one half seconds. Here the curve is almost flat; and a slight deviation of the speed in either direction would be of little practical consequence. Although this curve represents the performance of high-school seniors only, there is no reason to suppose that the same type of function will not hold for other homogeneous groups.

The introspections and reactions of the subjects were recorded. The test is predominately kinæsthetic; and the imagery of the subjects with few exceptions was of this type. In most cases it was associated with either visual imagery for colors or auditory imagery of color names. In a few cases the brighter children assisted their memories by numbering the blocks. Students who relied upon unreënforced kinæsthetic imagery, memory of jumps and directions, rarely succeeded in attaining a score in the upper quintile. Incidentally, one of the explanations of the excellence of the Knox Cube as a mental test is found in the premium it pays to resourcefulness and ingenuity.

In the high speeds the subjects found it hopeless to employ

any but motion imagery. They found it impossible to tap at a slow normal rate; it was only by tapping at the same high speed as the examiner that they could achieve any successful scores at all. In other words, they had only a memory of a rapid succession of bare movement sensations which could be reduced to action only in the same rapid bewildering succession.

It is our intention to make further investigations into the relationship between speed of presentation and accuracy of recall with material which will be presented to the subject but a single time. It would be interesting to discover the same continuous function between speed of presentation and ease of recall with such experimental material as rhythm tests, substitution tests, tachistoscope exposures, etc., as has been presented here in the case of the Knox Cube Test.

GENERAL REVIEWS AND SUMMARIES

VISION—GENERAL PHENOMENA

BY LEONARD THOMPSON TROLAND

Harvard University

In spite of the War, there has been no dearth of publications relating to vision during the past year. It is natural, however, that most of the articles should emanate from American sources, and that the studies of problems having a practical bearing, especially upon illuminating engineering, should constitute a considerable fraction of the whole.

In this field the problem of the visibility of radiation continues to attract investigation. Coblentz and Emerson (**10, 11**), in an important monograph, present new visibility data from 130 subjects, by far the largest number yet employed in an attempt to determine the average visibility curve. The flicker method of photometric equation was used, and the maximum of the average curve was found to lie at a wave-length of 557.6 $\mu\mu$. Individual variations naturally exist in the position of the maximum, in the spread of the curve and in its symmetry. High red sensitivity is the most common variation. Correction of the curve for the selective absorption of the ocular media gives a symmetrical curve with a maximum at 556 $\mu\mu$. Seven partially color-blind individuals were examined, and the results indicate that abnormalities in the form of the visibility curve accompany defective color vision, although the converse is not always true. The age of the observer has a noticeable influence upon the form of his curve.

The same authors (**12, 13**) compute the value of the "mechanical equivalent of light," on the basis provided by their new visibility data, as 0.00162 watts/lumen. In other words, one watt of radiant energy of maximal visibility is equivalent to 617 lumens of light, or 49.1 candles. The luminous efficiency of an ordinary tungsten lamp is found to be 1.42 per cent., referred to the maximally visible radiation as a standard.

Foote (**21**) develops a new equation for the visibility curve, based upon results previously obtained by Ives and Kingsbury. It

is more complex but also more accurate than Nutting's equation. Coblentz and Emerson (10) also discuss the visibility equation, and offer an amplification of the form proposed by Nutting. Göthlin (22) finds that the energy threshold for radiation between 680 and 820 $\mu\mu$ is an exponential function of the wave-length—of the form, $E = e^{(a\lambda - b)}$—for a three-degree macular field, but deviates slightly from this relation for a strictly foveal field. E is the threshold, e the base of the natural system of logarithms, λ the wave-length, and a and b are constants.

Hyde and Forsythe (29) have determined the temperatures of the ideal "black body" which correspond in color to various common illuminants, such as candle, gas, and kerosene flames, and different types of incandescent filaments. Kingsbury (39) has made similar measurements on gas flames under different conditions. These results—although seemingly physical—are all actually dependent upon and indicative of psychophysical constants or laws.

A number of articles deal with the question of the smallest quantity of radiant energy which can be visually perceived. Ives (30), the previous year, had calculated the radiation reaching the retina from a sixth magnitude star to be 38×10^{-10} ergs/sec./cm.^{2}, assuming a pupillary diameter of 6 mm. Russell (54) finds that under the usual conditions of astronomic observation the pupil is 8.5 mm. and that stars of a slightly higher magnitude than the sixth can be seen when there is a minimum of diffuse light in the sky. The corrected value of the minimum visible is 7.7×10^{-10}. This corresponds to about two hundred physical "quanta" of radiation entering the eye per second, and would amount to only one erg in forty years. Reeves (46, 48) attacks the same problem freshly with a direct experimental procedure and obtains an average value of 19.5×10^{-10} for three observers. An "artificial star," one millimeter in diameter and viewed at a distance of three meters, was employed; and the pupil, photographed by flashlight, had an average opening of 8.3 mm. Buisson (8) also reports an experimental determination yielding a value of 12.5×10^{-10}. Coblentz and Emerson (10), in discussing this same subject, point out that the retina is 300,000 times as sensitive as the best modern radiometer.

Reeves (47, 49), in general papers on pupillary and retinal adaptation, summarizes many of the important results recently obtained in the Eastman Laboratory, showing in a quantitative way the response of the eye to different levels of illumination.

The same investigations are also expounded by Hunger (**28**). Practically all of this work, which is of great value, has already been published in other articles.

Ferree and Rand (**20**) report a continuation of their previous investigations concerning the influence of different types of interior illumination upon the efficiency of the eye. Various forms of pendant, opaque reflectors were employed in the present work, and the ability of subjects to sustain clear seeing was the principal criterion applied. The same authors also present a general review (**19**) of their work on this problem. Their results indicate that the distribution of light is of more importance than absolute intensity in influencing visual efficiency, extremes of surface brightness being very undesirable. Semi-indirect reflectors of high density seem to be most conducive to eye comfort.

Ferree and Rand also reply sharply (**18**) to Johnson's criticism of their proposed method for heterochromatic photometry, and defend their experimental technique as well as the effectiveness of the method. Priest (**45**) discusses further his new procedure for the photometry of lights of different colors, in which he utilizes the rotary dispersion of quartz to obtain distributions of energy in the spectrum similar to that of the light which is to be photometered. Although the method is primarily physical, a study of its technique would repay those who are especially interested in the accurate control of complex visual stimuli.

Jones (**37**) reports a very thorough and accurate determination of the thresholds for hue difference throughout the spectrum. Expressed in terms of wave-length units, this threshold exhibits four minima and three maxima, the former occurring at 637, 585, 594, and 443 $\mu\mu$, the latter at 624, 538, and 464 $\mu\mu$, respectively. Between 400 and 700 $\mu\mu$, 128 threshold steps exist, and the smallest value of the threshold is 1.0 $\mu\mu$ at 588 $\mu\mu$. Although the measurements are on only one subject, they agree well with those previously published by Steindler. On the basis of these threshold determinations a "fundamental scale of pure hue" is established, practical applications of which are discussed.

Abney (**1**) presents measurements to show that in certain subjects a small proportion of rod vision exists in the fovea. Determinations were made on such subjects, who have a foveal "photochromatic interval," of the amount of "rod white" aroused by light of different wave-lengths. The spectral distribution curve of this "rod white" corresponds with that of ordinary rod vision,

but the absolute quantities indicate the relative insignificance of the process in the fovea. Abney finds (2) that subjects with night blindness have no photochromatic interval, the absolute threshold being the same as that for color in the normal eye. Göthlin (22) states that in his own foveal vision there is a photochromatic interval for red after adaptation to an illumination of 1,000 meter-candles, but for the totally dark-adapted eye a complete absence of the interval! According to this author, protanopes have a color threshold, between 640 and 760 $\mu\mu$, which is 16 times the light threshold. For the normal, dark-adapted eye, the rod and cone threshold curves intersect at 660 $\mu\mu$.

Arps (4) describes experiments which show that complementary mixtures of red, green and yellow matched in luminosity with mixtures of blue and yellow do not remain matched when the general illumination is lowered or when their relative positions with respect to the center of vision are exchanged. These facts are inconsistent with the Hering theory, but are not new.

A number of papers deal with after-image phenomena. Swindle (57) continues his discussion of positive after-images of long duration, and states that slight changes in illumination—properly timed—may revive such after-images with startling vividness. This observation is applied in an ingenious manner to the explanation of the traditional ghost, both nocturnal and diurnal apparitions being considered. The influence of changes of illumination upon after-images is also discussed by Troland (59), who finds that a faded after-image can be revived in negative form by dimming its projection field, or in positive form by brightening the latter. The effective duration of the after-image can thus be increased many fold. Brilliant color changes result when spectral stimuli are employed. Both the dimming and brightening effects can be explained on the assumption that the excitation of a retino-cerebral region temporarily lowers its resistance to alterations in any given state of excitation. Swindle points out that, owing to self-induction, colors tend to exchange places in an after-image, as compared with the original stimulus.

Ferree and Rand (16) report observations which show that areas can be found in the peripheral visual fields of many persons which are relatively blind to red, green, yellow, or blue, but which are not correspondingly deficient in the complementary after-image and other related reactions. The location of these spots varies from subject to subject. Sahni (55) discusses the colors seen through

the closed eyelids, and offers an obvious explanation based upon ocular blood-flow and after-image effects. Baumann (6) writes on the colors produced by Benham's top and similar devices. Crane (14), in a paper which is admirable in method, corroborates Kirschmann's law that maximal color contrast is conditioned by minimal luminosity contrast, and finds that the function connecting the two is symmetrical with respect to the maximum point. Cook and Kunkel's finding that light colors exert more color contrast effect than dark colors is attributed to the usually greater saturation of the former.

Two papers deal with binocular color mixture and retinal rivalry. Dawson (15) asserts that when the proper precautions are taken, no difference can be perceived between the luminosity or the color of an object seen with one eye and with two eyes. Rivalry between the two retinal fields increases with increase in the difference between the fields in any dimension: hue, saturation, luminosity, or contour. Luster is due entirely to luminosity differences. Baumann (6) describes a luster effect obtainable in monocular vision. Kuroda (40) discusses "mosaic retinal rivalry," in which the two retinæ contribute simultaneously to the contents of different parts of the "common visual field," and finds that similar features have a tendency to appear together, regardless of their retinal source. In general, the rivalry between any two corresponding retinal points is independent of that between other corresponding points.

Luckiesh (41) describes observations on the apparent distance from the eye of red and blue letters. When actually equidistant, seven observers found that the red letters appeared to be closer, while for two observers the blue seemed to be nearer. By the use of an artificial pupil the effect could be reversed or annulled, according to the position of the pupil. Other papers dealing with problems of the perceptual type are those of Ruckmich, Riddoch, Basler and Arps. The first (53) finds that temporal patterns of colors tend to be thrown into groups with accented members, producing a subjective visual rhythm. Riddoch (52) reports on a number of cases of wounds in the occipital region of the cranium. His observations corroborate the views of Holmes and Lister with regard to the representation of the retinæ on the cortex, and show that in the process of recovery the perception of movement precedes that of form. Basler (5) discusses phenomena involved in the perception of black lines on a white ground, while Arps (3) deals

with the visual discrimination of rectangular areas under various conditions of illumination.

The literature on vision for the year includes a number of significant theoretical papers, the majority of which are mathematical in method. Ives continues the development of his very successful and important theory of flicker and allied phenomena. In an article on "visual diffusivity," (33) he develops certain consequences of the view that this factor varies with the intensity and quality of the stimulus and with the species of receptor. He shows that the interval between perception and reception should be inversely as the diffusivity, and finds that experimental determinations of this interval for different colors and intensities, and for the rod as compared with the cone process, harmonize with the demands of the theory. In a second paper (34) Ives describes a new flicker photometer in which the two lights to be alternated are substituted for one another in accordance with a pure cosine law (of intensities as a function of time). With this instrument he has been able to meet the requirements of his original theory of the flicker photometer, and accurately to verify the theory in its application to critical flicker frequencies. He finds that the brightness discrimination fraction for the ultimate visual receivers with the flicker procedure is 0.00018, an astonishingly low value. The theoretical dependence of flicker-photometer frequency upon color difference is also discussed by Ives in a third paper (35), in which he shows that the experimentally established relationships can be explained on the basis of the threshold scale of hues and the color mixture triangle, without bringing in the visibility curve, as suggested by Troland. In a fourth paper (31) Ives discusses the possibility that the sluggishness of the visual process may be due to an inertia factor in the receptor mechanism, rather than in the conducting medium, as previously supposed. Grünbaum (23) finds that optical fatigue diminishes the ability to recognize flicker, but that on recovery from fatigue the ability rises above normal.

Nutting (43) summarizes the recognized laws of photochemical action, and develops a general mathematical expression for such action, which is consistent with the facts of visual and photographic sensibility, including the phenomenon of threshold. Troland (61) presents some further developments of his previously published formulation of the chemical theory of sensory response, showing that his equations explain Fechner's law, with its deviations. Some of the constants of the theory are roughly evaluated on the basis of

empirical data. In the same paper, it is shown that recognized facts relating to the electrical action of the retina can be combined with the Nernst-Lillie theory of nerve excitation to explain the continuous and graded conduction of visual intensities to the optic brain centers. Houstoun (**26**) offers a non-mathematical exposition of his theory of color vision, which is critically examined by Guild (**24**).

A general and very popularly written book on vision, *The Sense of Sight*, by Spindler (**56**) appears in the series on "Our Senses and What They Mean to Us." It is probably not intended to contain any new contributions to the subject. Reeves (**50**) presents a popular discussion of the evolution of vision.

A few articles bearing on vision from the comparative point of view may be mentioned briefly. Swindle (**58**) cites interesting observations tending to prove that the "eye appendages" of certain animals function so as constantly to vary the intensity of the light falling upon the eye, thus preventing the disappearance of fixated objects as a result of local adaptation. The photosensitivity of the skin of the fish, *Epinephelus striatus* Bloch, has been demonstrated by Jordan (**38**) to comply with the Bunsen-Roscoe law of photochemical action, and to decrease with continued stimulation. Hess (**25**) reports observations indicating that the color vision of poultry is similar to that of man, except for a relative blue-blindness. Patten (**44**) describes careful experiments on the reaction of the whip-tail scorpion to light, which show this animal to be typically negatively phototactic, but lacking in any power visually to perceive objects or movements. The intensity threshold of its response is 0.16 meter-candles, and the increase of response with intensity follows a saturation curve with an asymptote which is approximately reached at 1.0 meter-candle.

Among articles relating to experimental technique is one by Troland (**60**) on the measurement of visual stimulation intensities, which summarizes for the psychologist the principles of visibility and radiation, in the light of recent investigations. The relative merits and significance of radiometry and photometry, the justification of the flicker photometer, and the definition of equal heterochromatic luminosities, are other topics discussed. The final object of the paper is to define a practical unit of retinal illumination, the *photon*, in which the influence of intra- as well as extra-ocular factors is taken into consideration. Formulæ are developed for the application of this unit in connection with the artificial pupil. Ferree and

Rand (17), replying to critics of their previous articles, emphasize once more the theoretical advantages of radiometry as an objective measurement of visual stimulus intensities. They deny that extant visibility data can be regarded as furnishing an adequate calibration of the normal eye in energy terms, but admit that it may often be of more value to equate intensities of response than intensities of stimuli.

Reeves (51) reviews the literature on color filters, and describes in particular the valuable filters produced by the Eastman Kodak Company for research purposes. Luckiesh, in a long paper (42) which is full of useful information, gives exact spectral transmission and reflection curves for many common and special substances. A thoughtful study of this paper will be of advantage to many psychologists who are accustomed to use colored papers and glasses in visual experimentation. Johnson (36) offers a somewhat new design for a spectrometer intended for visual work, in which lenses are replaced by mirrors, which do not suffer from spherical and chromatic aberration. Clayden (9) describes a simple diffraction spectrometer, with a concave grating, designed to mix two homogeneous beams. Hübl (27) gives a description of a compact three-color-mixing apparatus, using half-silvered mirrors, color filters and neutral tint wedges, and intended for color matching. A "limen color mixer" which permits the mixture of colors in small and accurately determinable ratios is offered by Weiss (63). Rotating disks are employed on a principle similar to that previously applied by Hyde to the sector disk of the spectrophotometer. Only small stimulus areas can be obtained. Boring (7) presents a note on the substitution of gray papers of different luminosity for the black and white papers ordinarily used in class-room experiments with the method of equal sense intervals, and in the Kirshmann photometer. They have the advantage of being more permanent and of requiring less delicate means of angular measurement.

Ives (32) describes an improved visual acuity test-object, based upon the principle of crossed gratings. Gratings ruled in squares are employed so that the interference figures are also squares, of continuously variable size. A "focal variator" is offered by Weiss (62). This instrument permits objects or images to be presented to the eye with any desired degree of definition and allows of the accurate measurement of the latter.

REFERENCES

1. ABNEY, W. DE W. The Fourth Colorless Sensation in the Three-Sensation Spectrum Curves, when Measured on the Center of the Retina. *Proc. of the Roy. Soc.*, 1917, **94***A*, 1–13.
2. ABNEY, W. DE W. Two Cases of Congenital Night-Blindness. *Proc. of the Roy. Soc.*, 1917, **94***A*, 59–64.
3. ARPS, G. F. Visual Discrimination of Rectangular Areas Illuminated by Varying Degrees of Achromatic Light. *J. of Exp. Psychol.*, 1917, **2**, 41–62.
4. ARPS, G. F. An Experimental Note on an Assumption of the Hering Theory of Color Vision. (Proc. of Amer. Psychol. Assoc., 1916.) PSYCHOL. BULL., 1917, **14**, 47–48.
5. BASLER, A. Über die Verschmelzung von Formen. Über die Helligkeitsschwelle bewegten Felder. *Arch. f. d. ges. Physiol.*, 1917, **167**, 184–197, 198–227. (Accessible to the reviewer only through *Physiol. Abstr.*, 1917, **2**, 478.)
6. BAUMANN, C. Physiologie des Sehens. V. Subjective Farbenerscheinungen. VI. Monokulare Erscheinung einer Glänzerscheinung Reizwirkung von Schwarz *Arch. f. d. ges. Physiol.*, 1916, 166, 212–216; 1917, 168, 434–438. (Accessible to the reviewer only through *Physiol. Abstr.*, 1917, **2**, 477.)
7. BORING, E. G. Delboeuf Disks and the Kirschmann Photometer. (Notes from the Psychological Laboratory of Cornell University, II.) *Amer. J. of Psychol.*, 1917, **28**, 279–280.
8. BUISSON, H. The Minimum Radiation Visually Perceptible. *Astrophys. J.*, 1917, **46**, 296–297.
9. CLAYDEN, A. W. A Diffraction Color Box. *Proc. of the Phys. Soc.*, 1917, **29**, 176–181.
10. COBLENTZ, W. W., and EMERSON, W. B. The Relative Sensibility of the Average Eye to Light of Different Colors, and Some Practical Applications to Radiation Problems. *Bull. of the Bur. of Stand.*, 1917, **14**, 167–236.
11. COBLENTZ, W. W., and EMERSON, W. B. The Relative Sensibility of the Average Eye to Light of Different Colors and Some Practical Applications to Radiation Problems. *J. of the Franklin Inst.*, 1917, **184**, 309.
12. COBLENTZ, W. W., and EMERSON, W. B. The Luminous Radiation from a Black Body and the Mechanical equivalent of Light. *Bull. of the Bur. of Stand.*, 1917, **14**, 255–266.
13. COBLENTZ, W. W., and EMERSON, W. B. The Luminous Radiation from a Black Body and the Mechanical Equivalent of Light. *J. of the Franklin Inst.*, 1917, **184**, 109–110.
14. CRANE, R. L. The Effect of Absolute Brightness Upon Color Contrast. (Minor Studies from the Psychological Laboratory of Cornell University, XXXIX.) *Amer. J. of Psychol.*, 1917, **28**, 597–607.
15. DAWSON, S. The Experimental Study of Binocular Color Mixture, I. *Brit. J. of Psychol.*, 1917, **8**, 510–551.
16. FERREE, C. E., & RAND, G. Some Areas of Color Blindness of an Unusual Type in the Peripheral Retina. *J. of Exp. Psychol.*, 1917, **2**, 295–303.
17. FERREE, C. E., & RAND, G. A Note on the Needs and Uses of Energy Measurements for Work in Psychological Optics. *J. of Phil., Psychol., &c.*, 1917, **14**, 457–463.
18. FERREE, C. E., & RAND, G. A New Method of Heterochromatic Photometry. A Reply to Dr. Johnson. *Psychol. Rev.*, 1917, **24**, 159–173.

19. FERREE, C. E., & RAND, G. The Power of the Eye to Sustain Clear Seeing Under Different Conditions of Lighting. *J. of Educ. Psychol.*, 1917, **8**, 451–468.
20. FERREE, C. E., & RAND, G. Some Experiments on the Eye with Pendant, Opaque Reflectors Differing in Lining, Dimensions, and Design. *Trans. of the Illum. Eng. Soc.*, 1917, **12**, 464–487.
21. FOOTE, P. D. The Visibility Equation Derived from the Luminosity Equation. *J. of the Washington Acad. of Sci.*, 1917, **7**, 317–318.
22. GÖTHLIN, G. P. Studien über die Energieschwelle für die Empfindung Rot in ihrer Abhängigkeit von der Wellenlänge der Lichtstrahlung. *Kungl. Svenska Vetenskapsakadem. Handlingar*, 1917, **58**, No. 1, 89 pp.
23. GRÜNBAUM, A. A. Psychophysische und psychophysiologische Untersuchungen über Erscheinung des Flimmerns und optische Ermüdung. *Arch. f. d. ges. Physiol.*, 1917, **166**, 473–528. (Accessible to the reviewer only through *Physiol. Abstr.*, 1917, **2**, 325.)
24. GUILD, J. The Mechanism of Color Vision. *Proc. of the Phys. Soc.*, 1917, **29**, 354–361.
25. HESS, C. Der Farbensinn der Vögel und die Lehre von Schmuckfarben. *Arch. f. d. ges. Physiol.*, 1917, **166**, 381–426. (Accessible to the reviewer only through *Physiol. Abstr.*, 1917, **2**, 324.)
26. HOUSTOUN, R. A. A Theory of Color Vision. *Sci. Progr.*, 1917, **11**, 377–388.
27. HÜBL, A. v. Farben Apparat. *Phys. Zeits.*, 1917, **18**, 270–275. (Accessible to the reviewer only through *Sci. Abstr.*, 1917, **20**, 468.)
28. HUNGER, E. A. Effects of Varying Light on Sensibility of Eye. *Sibley J. of Engineering*, 1917, **32**, 2–5.
29. HYDE, E. P., and FORSYTHE, W. E. The Quality of Light from an Illuminant as Indicated by its Color Temperature. *J. of the Franklin Inst.*, 1917, **183**, 353–354.
30. IVES, H. E. The Minimum Radiation Visually Perceptible. *Astrophys. J.*, 1916, **44**, 124–127.
31. IVES, H. E. Evidence that Persistence of Vision is a Physical Conduction Phenomenon. *J. of the Franklin Inst.*, 1917, **183**, 779–780.
32. IVES, H. E. An Improved Visual Acuity Test-Object. *J. of the Opt. Soc. of Amer.*, 1917, **1**, 101–107.
33. IVES, H. E. Visual Diffusivity. *Phil. Mag.*, 1917, **33**, 18–33.
34. IVES, H. E. A Polarization Flicker Photometer, and Some Data of Theoretical Bearing Obtained with It. *Phil. Mag.*, 1917, **33**, 360–380.
35. IVES, H. E. Hue Difference and Flicker Photometer Speed. *Phil. Mag.*, 1917, **34**, 99–112.
36. JOHNSON, H. M. An Ideal Spectroscope for Use in Visual Work. (Proc. of the Amer. Psychol. Assoc., 1916.) PSYCHOL. BULL., 1917, **14**, 45.
37. JONES, L. A. The Fundamental Scale of Pure Hue and Retinal Sensibility to Hue Differences. *J. of the Opt. Soc. of Amer.*, 1917, **1**, 63–77.
38. JORDAN, H. Integumentary Photosensitivity in a Marine Fish, Epinephelus striatus Bloch. *Amer. J. of Physiol.*, 1917, **44**, 259–274.
39. KINGSBURY, E. F. The Color Temperature of Illuminating Gas Flames. *J. of the Franklin Inst.*, 1917, **183**, 781–782.
40. KURODA, G. The Principles of the Independent Function and of the Reciprocal Influence of Every Part of the Common Visual Feld. *Acta Scholæ Medicinalis Universitatis Imperialis in Kioto*, 1917, **1**, 473–489.

41. Luckiesh, M. On "Stereoscopic" Colors. *J. of the Franklin Inst.*, 1917, **183**, 773–775.
42. Luckiesh, M. The Physical Basis of Color Technology. *J. of the Franklin Inst.*, 1917, **184**, 73–93, 227–250.
43. Nutting, P. G. A Photochemical Theory of Vision and Photographic Action. *J. of the Opt. Soc. of Amer.*, 1917, **1**, 31–39.
44. Patten, B. M. Reactions of the Whip-Tail Scorpion to Light. *J. of Exp. Zool.*, 1917, **23**, 251–275.
45. Priest, I. G. A Proposed Method for the Photometry of Lights of Different Colors, III. *Phys. Rev.*, 1917, **10**, 208–212.
46. Reeves, P. The Minimum Radiation Visually Perceptible. *J. of the Franklin Inst.*, 1917, **184**, 719–720.
47. Reeves, P. The Effect of Various Physical Stimuli on the Pupillary Area and Retinal Sensibility. *J. of the Franklin Inst.*, 1917, **184**, 717–719.
48. Reeves, P. The Minimum Radiation Visually Perceptible. *Astrophys. J.*, 1917, **46**, 167–174.
49. Reeves, P. The Effect of Various Physical Stimuli on the Pupillary Area and Retinal Sensibility. *J. of Ophthalmol., Otol., and Laryngol.*, 1917, **23**, 616–626.
50. Reeves, P. The Evolution of Vision. *J. of Ophthalmol., Otol., and Laryngol.*, 1917, Oct. (Reprint.)
51. Reeves, P. Color Filters and Neutral Filters for Visual Experiments. Psychol. Bull., 1917, **14**, 249–253.
52. Riddoch, G. Dissociation of Visual Perceptions due to Occipital Injuries, with Especial Reference to Appreciation of Movement. *Brain*, 1917, **40**, 15–57.
53. Ruckmich, C. A. A Study of Visual Rhythm. (Proc. of the Amer. Psychol. Assoc., 1916.) Psychol. Bull., 1917, **14**, 45–46.
54. Russell, H. N. The Minimum Radiation Visually Perceptible. *Astrophys. J.*, 1917, **45**, 60–64.
55. Sahni, S. S. The Shut Eye Color Phenomena. (Proc. of the Physiol. Soc., 1917.) *J. of Physiol.*, 1917, **51**, xv–xvi.
56. Spindler, F. N. *The Sense of Sight*, 1917. Pp. 156.
57. Swindle, P. F. Visual, Cutaneous and Kinæsthetic Ghosts. *Amer. J. of Psychol.*, 1917, **28**, 349–372.
58. Swindle, P. F. The Biological Significance of the Eye Appendages of Organisms. *Amer. J. of Psychol.*, 1917, **28**, 486–496.
59. Troland, L. T. Preliminary Note: The Influence of Changes of Illumination Upon After-Images. *Amer. J. of Psychol.*, 1917, **28**, 497–503.
60. Troland, L. T. On the Measurement of Visual Stimulation Intensities. *J. of Exp. Psychol.*, 1917, **2**, 1–33.
61. Troland, L. T. The Nature of the Visual Receptor Process. *J. of the Opt. Soc. of Amer.*, 1917, **1**, 3–15.
62. Weiss, A. P. The Focal Variator. *J. of Exp. Psychol.*, 1917, **2**, 106–113.
63. Weiss, A. P. A Limen Color Mixer. *Amer. J. of Psychol.*, 1917, **28**, 409–418.

HEARING

BY R. M. OGDEN

Cornell University

Baird (1) reports a study of memory for absolute pitch as evidenced experimentally in nine musical observers. For the instruments used the order of ease of identification was, piano, organ, flute, clarinet and voice. With pure tones identification was poor. As regards the scale, the middle section was least difficult for all observers. Those pitches an observer can sing were generally the ones most easily identified, but there was no perfect coincidence of the two regions. "Naturals" were more readily identified than "accidentals," but in more than half the mal-identifications neither accidentals nor naturals were recognized as such. It therefore seems impossible to accept the common statement that accidentals are perceptually similar as a class, and perceptually different from the class of naturals. Individual differences were marked as regards the relative ease and difficulty of certain notes. From the total average it appears that *F* and *C* were most accurately identified with the piano, and *G* and *C* with the organ; while *C*♯ and *B*♭ proved the most difficult with both instruments. There was a general tendency to judge low tones too high, and high tones too low. Overestimations of pitch were relatively more frequent with the piano tones, and underestimations more frequent with the organ tones. Confusions of pitch were not based upon identity of overtones, since there was a greater confusion of notes between which the relation of the *fourth* obtained, than between those where the relation was that of the *fifth*. The most frequent confusions were of notes least subject to fusion. Octave errors were frequent, and found to be wholly different in nature from note errors. Observers were very accurate with some notes, and inaccurate with others. It was found that a note was more likely to be confused with its *third* or *sixth*, than with its *fourth* or *fifth*. The author finds his results pointing to the existence of certain *quales* of C-ness, D-ness, etc.; and he is doubtful if memory for absolute pitch can be acquired through training. In reaching these conclusions he fails to refer to the possible significance of distance-intervals as the possible basis for judgments of absolute pitch, or to Köhler's suggestions on the subject of training.[1]

[1] *Cf.* PSYCHOL. BULL., 1916, 13, p. 192.

Cameron (3) found among six subjects that four benefited by practice in singing tones at two different pitch levels, 100 and 225 v.d. Improvement was restricted to the pitch level practised, though an improvement in steadiness and uniformity of the tone sung was transferred to the other level. There was also an accompanying improvement in pitch discrimination at the level practised, but this was not transferred. A general tendency was manifest to sing the low tones too high, and the high tones too low. There was greater accuracy of pitch discrimination, than of motor ability in the reproduction of tones. The source of sound was an electrically driven fork communicated by means of a telephone receiver, and the registration of the tones sung was made on a smoked drum with the aid of a Cattell voice-key.

Seashore and Mount (19) report correlations of factors in musical talent and training selected from groups of test records made in four different years. In all, seventeen experimental tests were included, supplemented by answers to four questions regarding musical training, environment, expression and the enjoyment of music. The first series embraced a test for pitch discrimination and answers to the four questions. The second included these, and in addition tests for singing keynote, interval, scale and a test for singing the least producible variation from a sung note. The third series comprised tests for pitch, consonance and intensity discrimination, free rhythm, regulated rhythm, singing, auditory imagery, motor imagery and answers to questions regarding musical training, environment and the enjoyment of music. The fourth series included all the experimental tests of the third, except singing the scale and singing discriminative intervals. In addition, there were tests for hearing ability, time-sense, motor ability, rhythmic judgment, voluntary control of pitch and tonal memory. The minimal numbers of persons tested for the full series of each group varied from 190 to 225. The various tests were those devised and tried out in the Iowa Laboratory of Psychology with a view to standardization for application in the diagnosis of musical talent. One is struck by the prevailing lowness of the correlations. Positive correlations above .5 are found only between musical training and musical expression; between the four tests of singing; between tonal memory and pitch; and between tonal memory and the voluntary control of pitch in singing. Between hearing ability and pitch discrimination the correlation was .12; between musical enjoyment and consonance the correlation was negative, −.02,

in two series. One also notes very small or negative correlations between time-sense and rhythm: free, regulated, and rhythmic judgment. The authors conclude that the rhythmic tests are unreliable, but they assert the validity of the consonance tests, adding that "the burden of squaring musical procedure with these facts is therefore passed on to the musical profession."

Malmberg (8) attempts to discover the ranking order and to standardize the perception of consonant intervals. Tests were made with the piano, tuning forks and pipe organ. The ranking order was found to vary slightly with the different instruments, but no considerable differences could be attributed to the use of just and tempered intonation. The criteria adopted for consonance were: (1) blending—a seeming to belong together; (2) smoothness, or relative freedom from beats; (3) fusion, or unanalyzability and (4) purity, or a resultant analogous to a pure tone. These criteria were freely discussed with the eight observers, who worked together and used the method of the jury in reaching their conclusions. It was found that blending, purity and smoothness were consistent criteria by means of which the following rank order was attained: *octave*, *fifth*, *major sixth*, *major third* and *fourth*, *minor sixth*, *minor third*, *tritone*, *minor seventh*, *whole tone* and *major seventh*, *semi-tone*. With fusion alone as the criterion a different order was reached, approximately as follows: *octave*, *semi-tone*, *whole tone*, *fifth*, *minor third*, *major third*, *fourth*, *tritone*, *minor sixth*, *major sixth*, *minor seventh*, *major seventh*. Excepting the *octave* and *fifth*, this is an order based on increasing size of interval, though the author does not appear to have noted the fact. The first order is accepted as the standard for consonance and is compared favorably with the results of group tests previously secured; discrepancies being attributed to failure in the group tests to eliminate the factor of agreeableness. A system of weighting errors was worked out, and the distribution of grades reveals very great diversity of capacities among normal observers. As previously remarked, the perception of consonance is found to correlate very slightly with musical training and musical performance, and is accordingly regarded as "elemental in a secondary sense in so far as it is based rather on the elemental capacities for pitch discrimination and tonal memory." It may be noted, however, that the correlation with pitch discrimination was only .18, and with tonal memory .34. Malmberg does not refer to the experiments of Kemp[2] and Valen-

[2] *Cf.* PSYCHOL. BULL., 1914, 11, p. 100f.

tine,[3] though his results show interesting correspondences with both.

Gaw (6) has revised Malmberg's consonance test for practical purposes by eliminating undesirable intervals, simplifying the definition and conception of consonance, and adopting a system of demerits for the purpose of grading results. In the revision each interval appears at least once. There are eleven comparisons embracing a consonant with a consonant interval, a semi-consonant with a semi-consonant interval, a dissonant with a dissonant interval, and each of these three with each of the other two. The scheme is as follows, the more consonant interval being given first:

Octave with *semi-tone*, 11 demerits
Octave with *major seventh*, 10 demerits
Fifth with *major seventh*, 9 demerits
Major sixth with *major seventh*, 8 demerits
Major sixth with *whole tone*, 7 demerits
Fifth with *tritone*, 6 demerits
Major third with *minor seventh*, 5 demerits
Fifth with *minor sixth*, 4 demerits
Major third with *minor third*, 3 demerits
Major seventh with *minor seventh*, 2 demerits
Fourth with *major third*, 1 demerit

The instruction is: "A good combination (of two tones) is one which is *smooth*, in which the two tones *blend*, and seem to *agree* and *fuse together* into one. A bad combination (of two tones) is one which is *rough*, in which the two tones do not *blend*, and do not *seem* to *agree nor fuse together* into one."

Gordon (7) reports on tests of learning simple musical themes in comparison with learning specially constructed series of nonsense syllables, in which there were the same number of syllables as notes in the corresponding musical theme, with syllables repeated wherever a note was repeated. She found her observers divided into musical and non-musical groups. The former learned the musical themes with a median of 4 repetitions, and the nonsense syllables with a median of 6.5. The unmusical group learned the music with 13 and the syllables with 8 repetitions. Learning the same themes and syllables backwards gave a higher median for the music with both groups. There appears to be less difference in the ease of learning musical themes and nonsense syllables than between the learning of nonsense syllables and meaningful words. The

[3] *Cf.* PSYCHOL. BULL., 1915, 12, p. 163.

author concludes with a suggestion of a test for musical appreciation based upon the comparison of memory for significant and non-significant musical selections. Dashiell (4) has tested color and musical effects upon 212 kindergarten children. The musical tests were made with five intervals produced on the piano: the *major third*, *fifth*, *octave*, *major seventh* and *semi-tone*. Each interval was liked by a majority of the children. The number of affirmative to negative votes varied from 193 to 5 for the *major third*, to 111 to 87 for the semi-tone, the others ranging in the order given above. The writer suggests alternative interpretations which, however, hardly seem to constitute a dilemma. The first is that children lack esthetic sensibility; the second, that the esthetic sense is present but still plastic, and might develop along different lines than it does, if social conditions were other than they are.

With a specially devised apparatus in which resonators were moved towards and away from a suspended vibrating fork, Weiss (27) has secured results from judgments of intensity involving the comparison of 55 arbitrary steps with 6 standard positions of intensity. For the range selected an average of nine j.n.d.'s were found. By extending the intensities to include very loud and very weak tones, he estimates an average discrimination of twenty-five degrees of intensity. There follows an interpretation of the intensity reaction in terms of M. F. Meyer's theories of hearing and behavioristic response. This involves an ingenious schematization of nervous flux and distribution which, however, has no bearing upon the special interests of this summary. Richmond (16) also describes an apparatus for producing changes of intensity in sound without a click or other qualitative modification. A small electric buzzer of high pitch is run by a single dry cell, while a second cell through an inductorium, gives an independent current interrupted with the same frequency as the buzzer. Variations of resistance in the current through the inductorium produce changes of intensity in the sound without modifying the amount of current flowing through the buzzer magnets. A telephone receiver actuated by a secondary coil of the inductorium gives a tone of the same pitch as that of the electric buzzer. The arrangement permits a smooth change of sound intensity without other disturbances.

Miller (12, 13) describes his modifications of the Henrici Harmonic Analyzer, which increase the analyzable components from 10 to 30. The instrument is used in the registration and analysis of photographed sound waves. A 32-element harmonic synthesizer

is also described which makes possible a graphic presentation of each single component of a complex curve in its proper size and position, and also the resultant of all the components. Such a synthesis is useful in checking the analyses of photographed curves. The instrument will also draw corrected curves after allowances have been made for instrumental disturbances, etc.

In his study of binaural beats, produced by two slightly different tones separately conducted to the two ears, Stewart (**21, 22, 23, 24**) analyzes the wandering localization as "in front at 0 degree difference of phase, on the side of the fork with the higher frequency leading in phase from 0 degree to 180 degrees, and on the side of the slower fork with the higher frequency leading in phase from 180 degrees to 360 degrees, the changes of position being continuous, from front to rear (or within the head) and from rear to front." The localization was much more distinct in the half cycles in which the lead of the faster fork varied from $-$ 90 degrees to $+$ 90 degrees. With experienced observers the change in localization at 0 degree phase difference by the production of a very marked inequality of intensities was found to be slight. With attention upon intensity instead of localization, three distinct maxima were found: (1) at 0 degree difference of phase; (2) at 180 degrees $-\delta$, and (3) at 180 degrees $+\delta$, δ being less than 45 degrees. The existence of these secondary maxima of intensity lead the author to assume that their effects are due to conduction from one ear to the other through the head. The binaural beat period must be greater than two to five seconds in order to produce these secondary maxima. The conclusion reached opposes Peterson's contention that binaural beats are of cortical origin. According to Stewart the primary maxima are independent of beat period and are due to direct excitation of the ear drum and organs of Corti. The secondary maxima, on the contrary, are produced by conduction through the skull, and are attributed to distinct organs of hearing, presumably located in the saccule and utricule. The necessity of assuming a distinct organ of hearing for sounds due to bone conduction is perhaps obviated by Bing's conclusion (**2**) that such sounds are directly effective in the labyrinth, and are not conducted by way of the drum and ossicles, as has been usually supposed. Bing supports his views both by a theoretical consideration of sound effects upon the drum and ossicles, and also by references to clinical practice, particularly in the administration of the Weber, Rinne and Schwabach tests. With the Weber test sounds are

localized in the poorer ear when there is interference to air conduction in this ear. The facts are illustrated by Mach's experiment when a sound presented to the right ear is heard in the left one, if the left ear passage is closed with the finger. The sound is conducted from the right ear across the head to the left labyrinth. Its passage outwards being interfered with, it is heard in the left labyrinth. If with this test the sound is only heard in the right ear, the conclusion is that the deafness of the left ear is due to an affection of the nervous apparatus. The Rinne test consists in holding a vibrating fork against the skull behind the ear until the sound dies out. The fork is then brought before the ear passage and will normally be heard again; showing the greater sensitivity of the ear to air conduction. If it be not heard again the cause of deafness may be attributed to stoppage in the middle ear. A clinical case is cited in which the drum and ossicles of one ear were completely destroyed, while the other ear remained normal; yet it was still possible for the patient to hear with the defective ear by means of bone conduction.

In a note which fails to reveal the experimental basis of his conclusions, Sizes (**20**) elaborates his conception of the predominant tone of a sonorous body as the median term of a progression of eight octaves extending both below and above it. The musical sound is said to be a consequence rather than a cause of harmony. The intensity of the predominant sound is attributed to the coexistence of a large number of inferior, but separately imperceptible partials. In this complete harmonic series the median or predominant tone occurs between two adjacent notes, each separated from it by the interval of the *fifth;* hence, the important musical relations of *C* to the *G* above and the *F* below. Watson (**25**), investigating the transmission, reflection and absorption of sound by different materials, finds that porosity, density and elasticity all function in determining transmission. Porous bodies transmit sound in much the same proportion as they transmit air. Density stops sounds in proportion to the density. Elastic bodies transmit sounds if they are in tune with them. If the pitch is varied, porous and elastic walls will reflect the high-pitched sounds in greater degree than the low-pitched ones.

Marage (**9**) reports results of treatment with the vowel siren of different sorts of deafness incident to the war. Ten per cent. of his cases showed lesions of the middle ear, and all were amenable to treatment; 38 per cent. evidenced cerebral commotions, and of these

50 per cent. were cured. The remaining 52 per cent. were diagnosed as involving both forms of disturbance, and yielded 76 per cent. of cures. The treatment, details of which are not given, lasts five minutes per day, and 68 per cent. of unselected cases were able to return to the front. The author points out that auditory re-ëducation of this type is not a matter of pedagogy, and should be undertaken exclusively by qualified medical practitioners. The same author (**10, 11**) describes the use of the vowel acoumeter in detecting deafness, real and assumed. He criticizes the ordinary methods in force which do not even allow for the proportional decrease in the intensity of sounds with increase of distance from the source. Ranjard (**15**) reports on 100 cases of soldiers's deafness treated by the Marage method, in 84 of which positive results were obtained.

Watt (**26**) describes the results of measurements of the basilar membrane made by him from the photographs in A. A. Gray's *The Labyrinth of Animals* (2 vols., London, 1907–1908). He finds the cochlea to be built according to a constant plan in which the scale alone varies from specimen to specimen. There is a high correlation between the scale and the size of the organism as a whole. Variation in the number of whorls from the typical number, two and one half, occurs without any alteration of the basal plan of the cochlea. The cochlea grows by accretion at the apex, not at the base. There are two sources of change in the length of the basilar membrane. The chief of these is its own absolute increase in length, accompanying a greater number of whorls. The other is attendant upon a relative increase in the diameter of the tube. In length, the basilar membrane of man does not rank high among those of other animals, nor is man's cochlea the most regular and beautiful organ. The absolute length of the basilar membrane is not important for efficiency of hearing. Length in relation to the size of the organ as a whole is what counts. Perfection of efficiency is attributable to elasticity of the membrane and its relative length.

In R. Tigerstedt's *Handbuch der Physiologischen Methodik*, K. L. Schaeffer (**17**) contributes the section on methods of investigating the acoustical functions of the ear. A wide range of instruments and methods are considered with special regard for physiological procedure and results.

Seashore (**18**) points out the importance of avocational, as well as vocational tests, and cites the field of music as being one in which much time and money is wasted on the education of unfit

subjects, while persons who would profit by a musical education are often neglected. A set of tests is described embracing pitch discrimination, the sense of consonance, intensity discrimination, auditory memory and imaginal type. These were devised for fifth-grade pupils, and are being given in selected schools for the purpose of discovering incipient musical talent. The best ten per cent. of those tested are being followed up and encouraged to study music. Reference is also made to a special device for administering individual motor tests in which the basic powers of action, such as speed, accuracy and precision of voluntary movement, both in time and form; simple and complex reaction-time and timed-action, are registered graphically with a single instrument. Pond (14) applies the method of introspection in learning to play the French horn, and finds that although the mental processes involved are complex and intricate, the detection of errors is greatly aided by introspection. The resultant improvement of technique points to the value of such a method in connection with musical instruction. Gale (5) criticizes the prevailing methods of musical education, and points particularly to the lack of understanding of the musical classics on the part of teachers, and to the teaching of instruments rather than musical compositions, musical history and the musical ideas of great composers. He advocates the distinction of professional training, which should be undertaken in properly conducted conservatories, and musical culture, which should be within the province of schools and colleges. The private teaching of music could well be suppressed. Chamber music undertaken by small groups of amateurs is regarded as a better avenue to musical culture than the usual struggle to organize school and college orchestras. Individuals should also be taught to read music imaginatively, even though they may lack the technical facility of first-rate performers. Music should be removed from the "elocutionary" plane, and made a subject similar in import and value to the study of poetry. With less of discipline, and more attention given to the range of classical compositions; less of harmony and counterpoint, and more vivid recourse to musical history and the lives and ideas of eminent composers, music would find its highest function in the home, rather than in the concert hall, and become an art understood and appreciated by adults, and especially by men.

References

1. Baird, J. W. Memory for Absolute Pitch. *Studies in Psychology Contributed by Colleagues and Former Students of Edward Bradford Titchener.* Worcester, 1917. Pp. 43–78.

2. Bing, A. Kritisches zu den Stimmgabelversuchen und deren diagnostischer Wertung. *Arch. f. Ohrenheilk.*, 1915, **96**, 159–182.
3. Cameron, E. H. Effects of Practice in the Discrimination and Singing of Tones, *Psychol. Monog.*, 1917, **23**, No. 100, 159–180.
4. Dashiell, J. F. Children's Sense of Harmonies in Colors and Tones. *J. of Exper. Psychol.*, 1917, **2**, 466–475.
5. Gale, H. Musical Education. *Ped. Sem.*, 1917, **24**, 503–514.
6. Gaw, E. A. A Revision of the Consonance Test. *Psychol. Monog.*, 1918, **25**, No. 108, 134–147.
7. Gordon, K. Some Tests on the Memorizing of Musical Themes. *J. of Exper. Psychol.*, 1917, **2**, 93–99.
8. Malmberg, C. F. The Perception of Consonance and Dissonance. *Psychol. Monog.*, 1918, **25**, No. 108, 93–133.
9. Marage, —. Traitement des hypoacousies consécutives à des blessures de guerre. *C. r. acad. d. sci.*, 1915, **161**, 319–322.
10. Marage, —. Mesure de l'acuité auditive des surdités vraies et simulées. *C. r. acad. d. sci.*, 1916, **162**, 175–178.
11. Marage, —. Classement des soldats sourds d'aprés leur degré d'audition. *C. r. acad. d. sci.*, 1916, **162**, 801–804.
12. Miller, D. C. A 32-Element Harmonic Synthesizer. *J. of the Franklin Inst.*, 1916 (Jan.), 51–81.
13. Miller, D. C. The Henrici Harmonic Analyzer and Devices for Extending and Facilitating Its Use. *J. of the Franklin Inst.*, 1916 (Sept.), 285–322.
14. Pond, S. E. A Contribution to the Study of Instrumental Music. *J. of Appl. Psychol.*, 1918, **2**, 52–66.
15. Ranjard, —. Sur les cent premiers cas de surdité traités par la méthode de Marage au Centre de rééducation auditive de la 8e région. *C. r. acad. d. sci.*, 1917, **163**, 243–245.
16. Richmond, H. A. Quantitative Tonal Stimuli without Qualitative Change. *J. of Exper. Psychol.*, 1917, **2**, 100–105.
17. Schaeffer, K. L. Untersuchungsmethodik der akustischen Funktionen des Ohres. *Handbuch der Physiologischen Methodik* (R. Tigerstedt, Herausg.). Leipzig: Hirzel, 1914, III. Bd., Abt. IIIb, 204–394.
18. Seashore, C. E. Avocational Guidance in Music. *J. of Appl. Psychol.*, 1917, **1**, 342–348.
19. Seashore, C. E., & Mount, G. H. Correlation of Factors in Musical Talent and Training. *Psychol. Monog.*, 1918, **25**, No. 108, 47–92.
20. Sizes, G. Propriétés de la loi de résonance des corps sonores. *C. r. acad. d. sci.*, 1916, **162**, 634–637.
21. Stewart, G. W. Binaural Beats. *Phys. Rev.*, 1917, **9**, 502–508.
22. Stewart, G. W. The Secondary Maxima in Binaural Beats. *Phys. Rev.*, 1917, **9**, 509–513.
23. Stewart, G. W. The Theory of Binaural Beats. *Phys. Rev.*, 1917, **9**, 514–528.
24. Stewart, G. W. Binaural Beats. *Psychol. Monog.*, 1918, **25**, No. 108, 31–46.
25. Watson, F. R. An Investigation of the Transmission, Reflection and Absorption of Sound by Different Materials. *Phys. Rev.*, 1916, **7**, 125–132.
26. Watt, H. J. The Typical Form of the Cochlea and Its Variations. *Proc. of the Royal Soc.*, 1916, **89**, 410–421.
27. Weiss, A. P. The Tone Intensity Reaction. *Psychol. Rev.*, 1918, **25**, 50–80.

SPECIAL REVIEW

Le Courage. L. Huot & P. Voivenel. Paris, Alcan. 1917. Pp. vii + 358.

This book, to which M. Étienne, former minister of war, contributes a glowing preface, is a work not only of science, but of imagination. It was written in the shelters at the front. One of the authors, Huot, is, or was, a divisional army doctor with extensive military experience in the colonies, the other, Voivenel, an adjutant attached to the sixth French battalion. Both are shrewd and scientifically trained observers, and the book has accordingly high value as a first-hand study of the psychology of the soldier; both also are ardent patriots, and from the literary point of view the book is one more illustration from the war of the ability of French writers to express in words, as her soldiers are expressing in deeds, the passionate soul of France. An epigram in the chapter on "L'âme nationale" sums it all up: "On aime son pays comme une femme. On se bat pour lui mieux que pour une femme." It is amazing to see a work of this sort so richly documented. One does not exactly expect to find a *bibliothèque nationale* in the *cagnas*, yet here we have evidence not only of extensive personal observation, but of wide and varied reading; innumerable precise bibliographical references, direct citations from philosophers, scientists, military publicists, novelists and poets by the score. Moreover, the authors announce the preparation of a volume on *le Cafard* and one of them has actually found time to write, and has ready for publication after the war, a treatise on the psychology of smell, finding rich new material in the battlefield and the trenches! Evidently the popular impression of life at the front is in some need of modification.

Courage is defined as physical and moral steadfastness in the face of death, and heroism is to courage as genius is to talent. In the strict sense it implies the readiness of the individual to sacrifice his life to an ideal. It is the triumph of the instinct of social conservation over the instinct of self-conservation, of altruism over egoism. Hence, according to our authors, it is never found among animals, nor among the lowest races of man. The animal, even when it fights fiercest, obeys the instinct of conserva-

tion, of which the sexual and maternal instinct are expansions, and this instinct, so far from inciting to courage, is its most powerful antagonist. The same is true of the lowest savages; they live in the depths of forests, have no elevated sentiments, are impelled solely by self-interest, fight preferably from ambush, and in the paroxysm of combat are dominated by the instinct of conservation. Huot gives illustrations from his experiences in the African colonies. On the other hand, man is not so limited in his evolution as the animal, and even savages are capable, under discipline and imitation, of developing an *esprit de corps* and a fine loyalty of devotion first to their friends, finally to an idea. Huot cites, again from his African experience, the case of the brave Senegalese. At its best, in heroism, courage finds expression in the pure sacrifice of the individual without any reflected self-interest. It becomes, in fine, a religion. Everything depends on the presence of an ideal. "Of all things human the ideal is the most superhuman. The ideal makes man, the ideal is the mark of his superiority. A man dies from the death of his ideal, as the earth would die from the death of the sun. It is for this reason that *courage*, the sacrifice of the individual to the ideal, is at once so common and so wonderful, the imperishable flower of humanity."

The psychology of courage begins with the consideration of fear, the first manifestation, by its tendency to flight, of the instinct of conservation. A physiological theory is proposed which professes to combine the views of James and Sollier: there is a splanchnic fear of the psyche, and this supports James, and there is also a more intellectual fear of the *nous*, and this agrees with Sollier. But apart from the questionable accuracy of the representation of the doctrines of these authors, the mediation suggested is confused by the terminology, for, according to the scheme of the nervous system adopted, the "psychic," also called the intelligent, brain (Grasset's O center, Flechsig's association zones) is the highest, being distinguished both from the "organic" brain and from the visceral cœnæsthesia of the sympathetic system and the medulla oblongata. And in general it must be said that our authors contribute little to the general physiological theory of the emotions, being only too ready, as they express it, to watch the theoreticians at their exercises and to adopt and adapt each theory in turn as occasion serves. Much more important is the collection of observations and reflections in the chapters dealing with the anatomy of courage, with courage as affected by habit and experience, by the love of risk,

the sanctions which control fear and the contagion of collectivity, and as it manifests itself in battle. The chapter on the battle is one of the great chapters of the book. It deals with conditions before, during and after the battle. It follows Crile in its general theory and seeks to show that immediately before the assault the potential neuro-cerebral energy is in a state of tension, that during the combat all this potential energy is being used up, and that afterwards there is exhaustion. "I am all right physically," officers say, after a period of rest, "but I have not yet recovered morally . . . my spirit of offensive has not yet returned." Here again it is not the commonplace theory which is of chief value, but the vivid record of observed facts.

One returns in the end to the central thesis that courage in the form of heroism is the acceptance of the sacrifice of the individual to the ideal, the most exalted of the virtues. This may be so. Undoubtedly the ideal is the inspiration by which, in the large, heroism is engendered and sustained, and we do well in regarding objectively the sacrifices of the soldier as expressing his devotion to the country and its ideals. But we do not need to go beyond the pages of this book to see that this motive is crossed by others less sublime. There is, for instance, what our authors call the autoserotherapy of fear, the fear of death, of mutilation, of disgrace, which counteracts fear and keeps a man steady in the face of danger, and on the positive side, there is, as they also point out, the love of "glory" and of decorations. And if we look to the actual mental state of the soldier, do we not find that in the great crises the high inspirations fall away and that, so far from being exalted, it is reduced to something like the level of brute instinct, or even automatism? A French officer known to the writer described his own mental state during a charge as a perfect blank save for the blind impulse to go on and reach the goal. The two views are not incompatible, that war is "exaltation" and that war is "relaxation," and books like the present furnish the data by means of which they may in the end be reconciled.

H. N. GARDINER

SMITH COLLEGE

REPORT

DEFINITIONS AND DELIMITATIONS OF PSYCHOLOGICAL TERMS

PREPARED BY A COMMITTEE OF THE AMERICAN PSYCHOLOGICAL ASSOCIATION

Foreword

At the Chicago meeting of the American Psychological Association a committee was appointed "to consider the matter of uniformity in the usage of psychological terms."

The committee selected for examination a number of the more fundamental terms used in psychology. It was deemed inexpedient at present to recommend one definition exclusively for each term. Much of the confusion in recent discussions of psychological facts and concepts seems due to mutual misunderstanding of the different meanings attached to the same term by the various writers. Accordingly in some cases the committee found it desirable to recognize several distinct and incompatible alternative meanings for a given term. These alternatives were admitted, however, only where they represent the usage of a considerable number of writers.

After thorough discussion the committee agreed upon a tentative formulation of definitions and comments. These were printed and submitted to 150 psychologists for criticism. 60 replies were received and on the basis of these the report was revised. In certain cases the phraseology was amended; in other cases definitions were rejected or reduced to comments. The order of definitions was changed so as to conform with the majority preferences of the 60. It was found that the proposed definitions fell into three rather distinct groups as regards acceptibility, with modes at 90, 60, and 30 per cent. respectively. Definitions falling in the lowest group were for the most part rejected or reformulated; a few have been retained and are indicated by a dagger (†); that is, *definitions marked with a dagger represent the usage of a relatively small number of psychologists.*

The final formulations are given below. The report is unanimously approved by the committee, despite the fact that its

members represent very diverse standpoints. It should be understood, therefore, that in many cases the definitions given do not represent the personal usage of every member of the committee. In the case of certain fundamental terms the formulations are to be regarded as *delimitations* rather than definitions.

Definitions and Delimitations

I

1. **Psychology:**
   a. The science of *mental phenomena*.
   b. The science concerned with the mutual interrelations of *psychobiological organisms* and their *environment*.
   c. †The science of *selves*[a] in relation to their *environment*.
   d. †The science of mental *behavior*. [See Note at end.]

Comments: 1. *Psychology*[a] is intended as a general definition from any introspective standpoint. *Psychology*[b, c] are special definitions from "psychobiological" and "self" standpoints respectively.

2. Systematic *psychology* includes the facts of other disciplines so far as needed to explain *mental phenomena*.

2. **Psychological:**

Pertaining to *psychology*.

Comment: This adjective is often improperly used instead of *mental* or *psychical*.

II

3. **Mental phenomena:**
   a. Phenomena characterized by relation to consciousness.
   b. Phenomena pertaining to any of the following: *mind*, *consciousness*, *content of consciousness*, *self*[a], *subconsciousness*.
   c. Phenomena characterizing the subjective relations of *psychobiological organisms* with their *environment*.

Comment: It is generally agreed that not all phenomena arising from the relations between organisms and their environment are *mental phenomena*[c]; but no criterion of delimitation so far formulated has gained general acceptance. The phenomena attending growth (*e. g.*) would be excluded. The subjective phenomena attending neural reception, integration, and response—*e. g.*, sensation, feeling, thought, volition—are generally included.

4. **Mind:**

The totality or system of *mental phenomena*[a].

Comments: 1. These mental phenomena may be treated either alone or in connection with the bodily organization on the basis of which they are integrated.

2. *Mind* is also frequently used as a synonym for *soul*, for *psyche*, or for *self*[ab]. This use is not advisable on account of its equivocal character.

5. **Mental:**

a. Pertaining to *mind* or its *phenomena*.
b. Pertaining to *consciousness*.

6. **Mental life:**

Mental phenomena in the process of development and disintegration.

COMMENT: *Mental life* usually emphasizes the persistence of *mental phenomena* during the lifetime of the *individual;* its meaning is sometimes extended to include race history.

7. **(Mental) element:**

A (mental) fact which is apparently simple, *i. e.*, which remains unanalyzed at the present state of knowledge.

COMMENT: In *psychology* the term may be applied to certain *processes, items,* and *functions* of consciousness.

8. **Introspection:**

a. The direct observation of one's own *mental processes*.
b. †Direct observation of one's own feelings and other processes mediated by the somatic and splanchnic neurons. [See Note at end.]

COMMENTS: 1. It is not proper to apply the term *introspection* to the observation of the *object of consciousness* in the physical sense of the term.

2. The term **self-observation** is suggested as a synonym for *introspection*[a].

III

9. **Consciousness:**

a. The distinctive basal characteristic of *mental life* in actual process; *awareness*.
b. The subjective accompaniment of certain neural processes.
c. †The characteristic relation of *self*[a] to its *environment*.
d. †A generic group of *mental phenomena* characterized by one or more distinguishing features.

COMMENTS: 1. *Consciousness*[a] is not equivalent to *mind, self, soul,* or *psyche,* but is characteristic of them.

2. *Consciousness*[d] is generally qualified by an appropriate adjective; *e. g.*, religious consciousness, instinctive consciousness, perceptual consciousness, etc.

3. *Consciousness* is regarded by certain writers as incapable of any real definition.

10. **Subject of consciousness:**

That which is conscious.

11. **Object of consciousness:**

a. That of which the *subject of consciousness* is aware.
b. The *content of consciousness* viewed as a term in the subject-object relation.

12. **Content of consciousness; mental content:**

a. The items, collectively considered, which at any time constitute *mental life*.
b. The constituents of *mental life* at a given moment, viewed from the structural standpoint.
c. †Specific *objects of consciousness* at any moment.

13. **Process of consciousness; mental process:**

a. Change of *consciousness*.
b. Phenomena of *consciousness* considered as changing.

COMMENT: *Mental process*[a] includes the mode as well as the fact of change.

14. **Item of consciousness:**

Any single phenomenon of *consciousness*.

15. **Subconsciousness:**

Mental phenomena which in degree of vividness or clearness are below the limen or threshold of distinct consciousness; *subliminal consciousness*.

16. **(The) subconscious:**

A *mental life* or detached phase of mental life (judged to be present in an *individual*) of which the individual is not directly aware; a subordinate (or coördinate) consciousness.

COMMENT: The psychoanalytic school assumes that *the subconscious* is very highly organized.

17. **Unconscious:**

a. A term used to characterize activities of the organism unattended by *consciousness*.
b. A term used to describe such conditions as those of dreamless sleep and coma.

COMMENTS: 1. *Unconscious*[a] is often used to characterize reflex and autonomic activity; it is also used to characterize certain modes of instinctive activity, somnambulism, and perfectly formed habits.

2. The terms *subconsciousness*, *the subconscious*, and *unconscious* are constantly confused. The first two are especially apt to be confused in discussions concerning the existence of *the subconscious*. *Unconscious* is often used in place of *subconscious*, and also to distinguish the inorganic world from the organic. It is recommended that *unconscious* be confined to the uses here suggested, and that **non-conscious** be used to characterize the inorganic world.

18. **Awareness:**

A synonym for *consciousness*[a].

19. **Experience:**

a. Any modification of *consciousness* or the sum total of such modifications.

b. A psychical modification of the *psychobiological organism* which occurs either as an effect or concomitant of change in the *environment*.

COMMENTS: 1. The transitive verb **to experience** is often used as a synonym for *to be conscious of*, or *to be aware of*, with reference to the *object* or *content of consciousness*. To conform with this the noun **(the) experienced** may be used to denote the specific *object of consciousness* in contrast with (an or the) **experience**[a], *i. e.*, the specific *process of consciousness*. The term **experiencer** is correspondingly used to denote the *subject of consciousness* with **to experience** (intransitive verb) and **experiencing** (noun and adjective) to denote the occurrence of the phenomenon.

2. *Experience* is often used as a synonym for *consciousness*.

IV

20. **Self:**

a. A conscious *individual*[b], characterized by persistence and by change.

b. A *mind* regarded as consciously distinguishing itself from what is not itself.

c. A conscious *individual*[b] in union with an organized body.

d. The *individual* regarded as a progressively organized system of mental functions and processes.

e. The *subject of consciousness* (or *experiencer*) accompanying any complex of *mental processes* attentively experienced.

f. †A specific complex or integration of *content* in which the body as *object of consciousness* is fundamental.

COMMENTS: 1. The terms *subject* and **experiencer** have been used as synonyms for *self*[a]. A *self*[a] is both *subject* and *object of consciousness;* it is an *object of consciousness* directly, not merely through inference.

2. *Self*[e] and *self*[f] are never synonymous with *soul*, *mind*, *subject of consciousness*, or *experiencer*.

21. **Psyche:**

The being or nature manifested in *mental phenomena*.

COMMENT: *Psyche* is used as a synonym for *mind*, or as a substitute for the historic term *soul*. In this sense it is employed in recent literature by the followers of Freud.

22. **Psychic; psychical:**

Pertaining to *mind*, or to *consciousness*, or to *psyche; mental*.

COMMENT: *Psychic* is used (in psychiatry) to designate a certain class of disorders. It is also used to characterize a class of phenomena designated as telepathy, telekinesis, clairvoyance, etc.

23. **Soul:**

a. A somewhat indefinite historic term, formerly used to designate the generic subject-matter of *psychology*.

b. In modern usage, a synonym for *psyche*.

COMMENTS: 1. *Soul*[b] has been used historically with the following meanings, often accepted confusedly together: (i) life; (ii) spiritual substance; *i. e.*, a simple, unchanging, incorporeal being; (iii) conscious being; (iv) the moral and emotional consciousness; (v) disembodied spirit.

2. *Soul* is also sometimes used as a synonym for *self*.

24. **Individual:**

a. A single *psychobiological organism*.

b. A single being, uniquely determined and differentiated.

COMMENTS: 1. The *individual* is usually distinguished from (i) the social group; (ii) the type of a species, etc.

2. *Individual*[b] may be applied to *soul*, *self*, etc., as well as to the *psychobiological organism*.

V

25. **Psychobiological organism:**

A conscious, living unit.

26. **Environment:**

A term covering all physicochemical, biological, and social phenomena acting from without upon a given *organism*.

27. **Behavior:**

a. The reaction of an *organism* to its *environment* (biological usage).

b. Those simple or complex changes in an *organism* which

follow or are concomitant with *mental phenomena* and which may be observed in another organism than that of the observer or in his own (psychological usage).

c. †Any mental activity of an organism. [See Note at end.]

28. **Behavior psychology:**

The systematic presentation of *psychology* in terms of *behavior*.

Note.—The use of the terms *Behavior* and *Introspection* in the senses defined or implied in 1d, 8b, and 27c is sanctioned by a number of writers in good standing. The majority of the committee are of the opinion, however, that such use is likely to cause confusion and misunderstanding.

HOWARD C. WARREN,
Chairman
MARY W. CALKINS,
KNIGHT DUNLAP,
H. N. GARDINER,
CHRISTIAN A. RUCKMICH

BOOKS RECEIVED

BREESE, B. B. *Psychology*. New York: Scribners, 1917. Pp. x + 482.

DOLL, E. A. *Clinical Studies in Feeble-Mindedness*. Boston: Badger, 1917. Pp. 232. $2.50.

KAHN, L. *Metaphysics of the Supernatural as Illustrated by Descartes*. New York: Columbia Univ., 1918. Pp. 66.

BALZ, A. G. A. *Idea and Essence in the Philosophies of Hobbes and Spinoza*. New York: Columbia Univ., 1918. Pp. 86.

MULLAN, E. H. *The Mentality of the Arriving Immigrant*. Washington: Gov. Printing Office, 1917. Public Health Bulletin No. 90.

MONTESANO, G. *La Suggestione* (Estratto da 'L'assistenza dei Minorenni Anormali'). Roma, 1917. Pp. 29.

ABRAMOWSKI, E. *Le Subconscient Normal*. Paris: Alcan, 1914. Pp. 442. 8 fr. 25.

DIDE, M. *Les Emotions et la Guerre*. Paris: Alcan, 1918. Pp. 273. 5 fr. 50.

PINTNER, R. *The Mental Survey*. New York: Appleton, 1918. Pp. x + 116. $2.00.

JONES, E. S. *The Influence of Age and Experience on Correlations Concerned with Mental Tests.* Baltimore: Warwick & York, 1917. Pp. 89. $1.25. (Educational Psychology Monographs No. 22).

ADLER, F. *An Ethical Philosophy of Life.* New York: Appleton, 1918. Pp. viii + 380. $3.00.

EVERETT, W. G. *Moral Values.* New York: Henry Holt, 1918. Pp. xiii + 439. $2.50.

LYON, D. O. *Memory and the Learning Process.* Baltimore: Warwick & York, 1917. Pp. 184. $2.00.

SPAULDING, E. G. *The New Rationalism.* New York: H. Holt, 1918. Pp. xviii + 532. $3.50.

GARDNER, C. S. *Psychology and Preaching.* New York: Macmillan, 1918. Pp. 389. $2.00.

TERMAN, L. M. *Stanford Revision of the Binet-Simon Intelligence Scale.* Baltimore: Warwick & York, 1917. Pp. 184. $1.40. (Educational Psychology Monographs No. 18).

WOODWORTH, R. S. *Dynamic Psychology.* New York: Columbia Univ., 1918. Pp. 210. $1.50.

GORDON, K. *Educational Psychology.* New York: Holt, 1917. Pp. vi + 294. $1.35.

PINTNER, R., & ANDERSON, M. M. *The Picture Completion Test.* Baltimore: Warwick & York, 1917. Pp. vii + 101. $1.25. (Educational Psychology Monographs No. 20).

COOVER, J. E. *Experiments in Psychical Research at Leland Stanford University.* Stanford Univ.: Stanford Univ., 1917. Pp. xxiv + 641. $3.50.

NOTES AND NEWS

THE reorganization of the Council of National Defense, with the National Research Council as one of its divisions, has resulted in the grouping of the psychological work under the section of medicine of the Research Council. The following subcommittees are continued: Methods of Examination of Recruits, Tests of Special Skill, Problems of Aviation, Incapacity and Reeducation, and Visual Problems.

THE following members of the American Psychological Association have been commissioned in the Sanitary Corps of the Army for psychological examining: A. T. Poffenberger, G. C. Myers, S. Isaacs. A full list of those members of the Association who have undertaken special war work has been promised and will appear in an early number of the BULLETIN.

THE medical journals have contained the announcement of the death of Dr. Henry Maudsley, the distinguished English psychiatrist, at the age of eighty-three years.

ON account of the general situation and on account of the number of members of the Society who are engaged in various forms of National Service the Council of the Southern Society for Philosophy and Psychology has decided to abandon the annual meeting which was scheduled to be held at Peabody College, Nashville, Tenn., this spring.

A CORRESPONDENT writes that a Swiss newspaper contained a notice of the death of Professor Ewald Hering, in Leipzig, in February.

THE following items have been taken from the press:

A COMMITTEE on Education and Special Training has been created by the War Department to study the needs of the various branches of the service for skilled men and technicians; to determine how such needs shall be met, whether by selective draft, special training in educational institutions, or otherwise; to secure the cooperation of the educational institutions of the country; and to administer such plan of special training in schools and colleges as may be adopted. The committee consists of Colonel Hugh S. Johnson, deputy provost marshal general; Lieutenant Colonel

Robert I. Rees, of the General Staff; and Major Grenville Clark, of the Adjutant General's Department. The committee will be assisted by the following civilians: Charles R. Mann, Massachusetts Institute of Technology; James R. Angell, University of Chicago; J. W. Dietz, Western Electric Company, president of the National Association of Corporation Schools; James P. Monroe, member of the Federal Board for Vocational Education; and Samuel P. Capen, United States Bureau of Education, specialist in higher education.

THE University of Rochester has expanded its work in psychology, and quarters are now provided for a laboratory which is equipped for experimental purposes. Dr. L. A. Pechstein has been appointed to take charge of the work.

PROFESSOR R. H. SYLVESTER, University of Iowa, has joined the psychological division of the officers' training camp at Fort Oglethorpe, Ga.

DR. FRANCIS N. MAXFIELD, assistant professor of psychology at the University of Pennsylvania, has been appointed psychologist in the public school clinic of Newark, N. J.

PROFESSOR B. T. BALDWIN, University of Iowa, has been commissioned major in the Sanitary Corps.

DR. H. H. GODDARD has been appointed head of the Bureau of Juvenile Research of the State of Ohio.

PROFESSOR E. B. HOLT, assistant professor of psychology at Harvard University, has tendered his resignation to take effect September 1, 1918.

THE psychological laboratory at Mt. Holyoke College which was destroyed by fire during the Christmas vacation is now being accommodated in another building.

AT the February meeting of the New York Branch of the American Psychological Association the following papers were read: G. Strickland, The Influence of Practice on Correlation of Abilities; C. F. Chassel, A Tentative Formulation of a Psychology of Play; D. R. Brimhall, Families of American Men of Science; L. I. Stecher, A Note on a Mathematical Prodigy; H. L. Hollingworth, Redintegrative Mechanisms in the Psychoneuroses.

PROFESSOR M. E. HAGGERTY, of the University of Minnesota, has been commissioned major in the Sanitary Corps, to undertake work in connection with special hospitals and the reeducation of disabled soldiers.